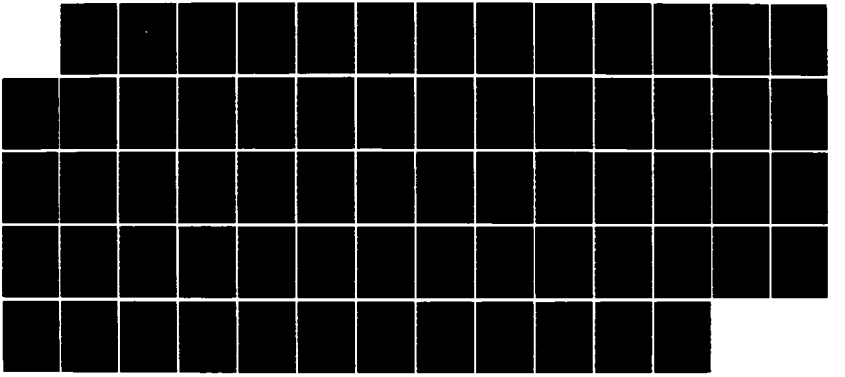
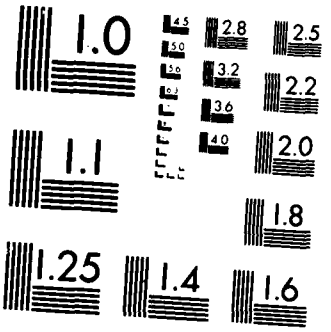
AD-A173 553 THE IMPACT OF LOCAL LABOR MARKET FACTORS ON ARMY RESERVE ACCESSIONS(U) NAVAL POSTGRADUATE SCHOOL MONTEREY CA B G HOLZBERGER JUN 86 1/1

UNCLASSIFIED F/G 5/9 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

AD-A173 553

(2)

NAVAL POSTGRADUATE SCHOOL
Monterey, California

DTIC
ELECTE
NOV 4 1986
S D
B

THESIS

THE IMPACT OF LOCAL LABOR MARKET FACTORS ON ARMY RESERVE ACCESSIONS

by

Bradley G. Holzberger

June 1986

Co-Advisor: G. W. Thomas
Co-Advisor: S. L. Mehay

Approved for public release; distribution is unlimited.

DTIC FILE COPY

86-11 4 068

SECURITY CLASSIFICATION OF THIS PAGE

AD-A173 553

REPORT DOCUMENTATION PAGE

1a REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b RESTRICTIVE MARKINGS
2a SECURITY CLASSIFICATION AUTHORITY	3 DISTRIBUTION / AVAILABILITY OF REPORT Approved for public release; distribution is unlimited.
2b DECLASSIFICATION / DOWNGRADING SCHEDULE	
4 PERFORMING ORGANIZATION REPORT NUMBER(S)	5 MONITORING ORGANIZATION REPORT NUMBER(S)
6a NAME OF PERFORMING ORGANIZATION Naval Postgraduate School 6b OFFICE SYMBOL (If applicable) Code 54	7a NAME OF MONITORING ORGANIZATION Naval Postgraduate School
6c ADDRESS (City, State, and ZIP Code) Monterey, California 93943-5000	7b ADDRESS (City, State, and ZIP Code) Monterey, California 93943-5000
8a NAME OF FUNDING / SPONSORING ORGANIZATION 8b OFFICE SYMBOL (If applicable)	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c ADDRESS (City, State, and ZIP Code)	10 SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO / PROJECT NO / TASK NO / WORK UNIT ACCESSION NO

11 TITLE (Include Security Classification)
THE IMPACT OF LOCAL LABOR MARKET FACTORS ON ARMY RESERVE ACCESSIONS

12 PERSONAL AUTHOR(S)
Holzberger, Bradley G.

13a TYPE OF REPORT	13b TIME COVERED	14 DATE OF REPORT (Year, Month, Day)	15 PAGE COUNT
Master's Thesis	FROM _____ TO _____	1986 June	65

16 SUPPLEMENTARY NOTATION

17 COSATI CODES			18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Army Reserve, manpower, supply models

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

This thesis analyses the impact of local labor market forces on Army Selected Reserve accessions in the period FY 83-85. Accession data from the Defense Manapower Data Center was broken down to zip code level and then aggregated upwards to local market counts. These counts wre then merged with similarly aggregated economic data from the Defense Manpower Data Center DORIS database. The resulting file was analysed using (OLS) regression techniques to identify characteristics of potentially high yield Reserve recruiting markets.

20 DISTRIBUTION / AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	21 ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
22a NAME OF RESPONSIBLE INDIVIDUAL G. W. Thomas	22b TELEPHONE (Include Area Code) (408) 646-2741 22c OFFICE SYMBOL 54Te

DD FORM 1473, 84 MAR 83 APR edition may be used until exhausted
All other editions are obsolete

SECURITY CLASSIFICATION OF THIS PAGE

Approved for public release; distribution is unlimited.

The Impact of Local Labor Market Factors
on Army Reserve Accessions

by

Bradley G. Holzberger
Captain, Royal Australian Corps of Transport
B.A.(Hon), Royal Military College Duntroon, 1979.

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
June 1986

Author: _____
Bradley G. Holzberger

Approved by: _____
G.W. Thomas, Co-Advisor

_____
S.L. Mehay, Co-Advisor

_____
W.R. Greer, Jr., Chairman,
Department of Administrative Science

_____
Kneale T. Marshall,
Dean of Information and Policy Sciences

ABSTRACT

This thesis analyses the impact of local labor market forces on Army Selected Reserve accessions in the period FY 83-85. Accession data from the Defense Manpower Data Center was broken down to zip code level and then aggregated upwards to local market counts. These counts were then merged with similarly aggregated economic data from the Defense Manpower Data Center DORIS database. The resulting file was analysed using OLS regression techniques to identify characteristics of potentially high yield Reserve recruiting markets.

QUALITY INSPECTED 4

A-1

TABLE OF CONTENTS

I. INTRODUCTION 8

A. PURPOSE AND SCOPE OF THIS THESIS 11

B. A PROFILE OF TODAY'S RESERVE 12

C. OUTLINE OF THE THESIS 14

II. ECONOMIC THEORY AND LITERATURE REVIEW 15

A. THE DECISION TO MOONLIGHT 15

1. The Economic Model 15

2. The Special Case of Reserve Participation 20

B. A REVIEW OF MILITARY SUPPLY MODELS 22

1. Active Force Supply Studies 23

2. Reserve Force Supply Studies 29

C. CONCLUSIONS 33

III. DATA AND METHODOLOGY 35

A. DATA SOURCES 35

B. METHODOLOGY 35

1. Data Aggregation 35

2. Model Specification 38

IV. EMPIRICAL ANALYSIS AND RESULTS 43

A. DIRECT ACCESSION COUNT MODEL 43

B. ACCESSION PROPORTION MODEL 49

C. SUMMARY OF RESULTS 51

V. CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH. 53

A. CONCLUSIONS 53

B. AREAS FOR FURTHER RESEARCH 54

APPENDIX A: VARIABLE DEFINITION 57

APPENDIX B: ACCESSION COUNT MODELS RESULTS 59

APPENDIX C: ACCESSION PROPORTION MODELS RESULTS 60

APPENDIX D: FEMALE LOG LINEAR MODELS RESULTS 61

LIST OF REFERENCES 62

INITIAL DISTRIBUTION LIST 64

LIST OF TABLES

1. SELECTED RESERVE MANPOWER SEPTEMBER 1985 10

2. SELECTED RESERVE PROFILE - SEPTEMBER 1985 13

3. SELECTED RESERVE RECRUITS - FY 85 13

4. LABOR MARKET SUMMARY DATA 39

5. NPS MALE ACCESSION MODEL 44

6. ACCESSION PROPORTION MODEL 50

LIST OF FIGURES

2.1 Labor Market Participation Model 16

I. INTRODUCTION

The inception of the AVF in 1972 was a watershed in US Defense policy. Since then the cost of meeting manpower and strength requirements has remained at the forefront of the Defense debate. To maintain readiness in the face of budget restrictions the Administration has been pursuing a policy of increasing Reserve manning whilst maintaining a cap on Active force end strengths. This is based on the assumption that Reserve forces are less expensive than Active forces to maintain because reservists are paid only for the time they actually spend at drills. The contribution that Reserve forces make to overall readiness has been increasing steadily since the inception of the AVF for two major reasons. First, escalating personnel costs have forced planners to limit the size of Active forces. Second, the removal of the draft has diminished the capability of the Active force to quickly expand and mobilize. Currently, any significant mobilization would require Reserve augmentation of Active forces almost immediately. [Brinkerhoff and Grissmer,1984: p.8].

To meet this expanding role Reserve forces are organized into three categories; the Ready Reserve, the Standby Reserve and the Retired Reserve. The Ready Reserve is the

primary contributor to readiness and it is composed of the Selected Reserve and the Individual Ready Reserve (IRR). The IRR consists of individuals who train irregularly and whose role is augmentation of existing units during mobilization. The Selected Reserve is the most significant component of the Reserve force and it consists of units which are organized and equipped to perform specific missions; trained personnel who augment Active units; and individuals in training pipelines. Members of the Selected Reserve are required to attend weekend drills regularly throughout the year and at least one period of active duty training annually. This thesis focuses on the Selected Reserve.

The impact of recent Defense manpower policy has been that while Active force levels have remained constant over the last decade, Selected Reserve end strengths have risen from 788,000 in 1978 to 1,100,652 in September 1985. [Defense Manpower Data Center,1985: p.1]. A breakdown of current Selected Reserve strength by components is shown in Table 1. All components are projecting future increases in end strengths for Selected Reserve forces. For example, the Army manpower plan submitted in the February 1985 budget projected an increase of 116,000 members of the Army Selected Reserve (United States Army Reserve and Army Reserve National Guard) by 1990. This represents an increase of 16 percent of current end strength over five years. [Congressional Budget Office,1985: p.1].

TABLE 1

SELECTED RESERVE MANPOWER
SEPTEMBER 1985

Army Reserve National Guard	439,952
United States Army Reserve	292,080
United States Navy Reserve	129,832
United States Marine Corps Reserve ..	41,586
Air National Guard	109,398
United States Air Force Reserve	75,214
DoD Total	1,008,062
United States Coast Guard Reserve ...	12,590
Total	1,100,652

Source: Defense Manpower Data Center, Official Guard and Reserve Manpower Strengths and Statistics, September 1985.

Meeting these expansion requirements efficiently will depend upon a sound understanding of the impact of factors which affect Reserve force supply levels. At present that type of information is not available. A recent Rand Corporation review of the Reserve concluded:

> Forecasting Reserve accession levels is beset with a great deal of uncertainty until ongoing research is able to sort out the various factors affecting enlistments and make some determination regarding their possible magnitude and direction of effect. [Brinkerhoff and Grissmer,1984: p.29].

A further indicator of the paucity of projection information available was the reliance by a recent Congressional Budget Office study of Army Reserve manpower on a supply model estimated in 1981 by William McNaught of the Rand Corporation. [Congressional Budget Office,1985:

p.59]. As well as being dated , the policy parameters estimated by that model are of questionable validity, as is shown later in this thesis.

A. PURPOSE AND SCOPE OF THIS THESIS

The purpose of this thesis is to develop an econometric supply model for the Reserve forces. Because the Reserves recruit and operate in local labor markets, the primary focus will be an attempt to identify and quantify those local labor market factors which are most important for Reserve supply. This emphasis on geographic disaggregation is necessary because while Active force recruits leave the local market, reservists generally maintain their primary employment in the local labor market. The disparity in local labor market conditions across the country must then be taken into account if the Reserve forces are to efficiently meet their manpower goals.

An econometric model of this type can assist policy formulation in the following areas:

- allocation of new authorizations,
- location of new units,
- assessment of the long term viability of existing units,
- allocation of recruiting resources.

The thesis will distinguish between non prior service (NPS) and prior service (PS) accessions to the Reserve when

estimating the models developed for two reasons. Stagnant Active force end strengths and increasing retention implies that the pool of potential PS reservists will be shrinking. [Brinkerhoff and Grissmer,1984: p.29]. Also NPS and PS recruits are probably influenced differently by local economic conditions and incentives. The distinction between the two categories is important. In FY 85, 63 percent of DoD reserve accessions were PS personnel. [Defense Manpower Data Center,1985: p.178]. However the shrinking PS pool implies that the projected Reserve manpower expansion will have to be fuelled primarily by NPS accessions.

Models developed in this thesis will only be estimated for Army Selected Reserve data. This is because Army components represent 67 percent of current Selected Reserve manpower (see Table 1) and Army units are the best examples of units which are forced to survive within the confines of their local labor market. Air Force and Navy Reserve units have more flexibility in recruiting for and manning units from outside their local areas.

B. A PROFILE OF TODAY'S RESERVE

When considering the impact of economic policy tools it is important to have an appreciation for the underlying population that is being targeted. Table 2 provides a force profile for the DoD Selected Reserve in 1985 to assist in this assessment.

TABLE 2

SELECTED RESERVE PROFILE - SEPTEMBER 1985

	ENLISTED STR	% MINORITY	% FEM	AVG AGE	AVG YOS	% HSG
ARNG	397,612	23	5	30	8	57
USAR	238,220	36	17	29	7	50
USNR	106,529	17	11	31	9	64
USMCR	38,204	27	4	24	4	73
ANG	96,361	12	12	34	11	79
USAFR	59,599	23	18	33	10	76
DoD	936,525	25	10	-	-	-

Source: Defense Manpower Data Center, Official Guard and Reserve Manpower Strengths and Statistics, September 1985.

Table 3 displays a profile of Reserve recruits in FY 85 by components.

TABLE 3

SELECTED RESERVE RECRUITS - FY 85

	RECRUITS	%PS	%MINORITY	%FEMALE	%HSG
ARNG	82,952	53	23	6	61
USAR	74,894	61	38	17	43
USNR	33,130	90	21	14	75
USMCR	9,737	45	30	6	77
ANG	14,863	64	12	17	90
USAFR	13,194	77	22	23	93
DoD	228,770	63	27	12	62

Note: Defense Manpower Data Center defines prior service as any amount of previous service in a uniformed federal service, including previous service in any reserve component.

Source: Defense Manpower Data Center, Official Guard and Reserve Manpower Strengths and Statistics, September 1985.

C. OUTLINE OF THE THESIS

In Chapter II the economic theory which describes the motivation of participation in the Reserve is discussed and previous studies of both Active and Reserve manpower supply are reviewed. A theoretical Reserve supply model is developed.

Chapter III describes the data base and methodology used to estimate the econometric supply model. Chapter IV reports the parameter estimates and elasticities obtained from the model. The policy implications of the estimates are discussed. In Chapter V the results of the study are reviewed and suggestions are made regarding potentially fruitful areas for further research.

II. ECONOMIC THEORY AND LITERATURE REVIEW

A. THE DECISION TO MOONLIGHT

1. The Economic Model

"Moonlighting" is a term used to describe undertaking a second job in addition to holding a primary full or part time job. Shishko and Rostker have attempted to model moonlighting behavior using an extension of the standard work/leisure choice model of labor force participation. [Shishko and Rostker: 1976]. The model is depicted in Figure 2.1.

The model characterizes the choice to work as a tradeoff between the individual's desire for income (from work) and leisure time. In Figure 2.1 hours of work or leisure are on the horizontal axis and the vertical axis measures income. The indifference curves U^0, U' and U" each depict a locus of leisure/income combinations between which the individual is indifferent. Overall utility increases as the indifference curve shifts away from the origin. The slope of W^0 measures the wage rate in the individual's primary job. To maximize his utility the individual will seek the point where his primary wage rate exactly equals the slope of the highest attainable indifference curve. This is point A which indicates a desire to work for 52 hours per

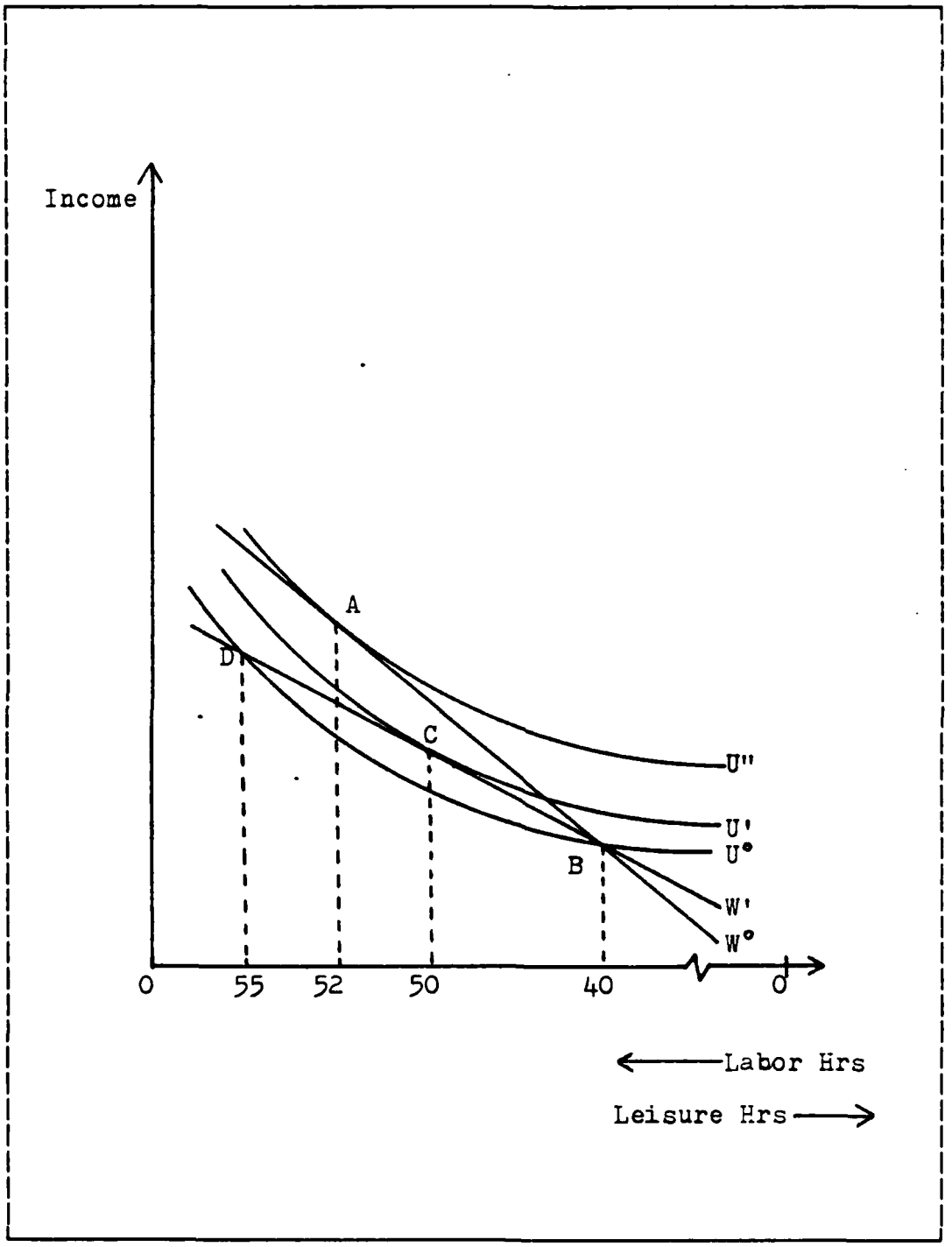


Figure 2.1 Labor Market Participation Model

week. In the primary labor market however, most individuals are limited by employers to 40 work hours, depicted in the model by point B. Thus point A is unattainable. This individual will then be motivated to seek a second job to increase his utility. If he can secure a job that pays wage W' for example he will wish to move to point C. By working an additional 10 hours on the second job he improves his utility to U'. This model suggests a number of factors that affect the decision to moonlight.

Second job wage. If the individual is at point B the minimum wage which will induce him to take a second job is equal to the slope of U^0 at point B. This is the moonlighting reservation wage. As the secondary wage increases above this the moonlight hours desired will increase. If the wage continues to rise however an income effect may start to restrict the number of hours desired on the second job. Coupled with this is a consideration of costs associated with the second job, for example transport costs. These costs increase the moonlighting reservation wage and decrease the probability that the individual will choose to moonlight. [Borack et al,1985: p. 16]. Conversely non-wage benefits accruing on the moonlighting job will have the opposite effect.

Primary wage. The effect of a change in the primary wage rate on the moonlighting decision is ambiguous. An

increase in the wage can increase or decrease the moonlight reservation wage and the number of moonlight hours desired. [Shishko and Rostker, 1976: p. 299].

Primary job hours. A change in primary job hours can have differing effects on moonlighting decisions depending on the relationship between the primary and secondary wage rates. Generally an increase in primary job hours worked will decrease the probability that an individual will moonlight, or the number of moonlighting hours desired.

Secondary job hours. Restrictions on the number of hours available on the second job are just as likely to occur as primary job hour restrictions. The Reserves are a good case in point because members are contractually obliged to work fixed hours monthly and attend a period of full time training once a year. The impact of these restrictions may vary but it can be characterised by the model. Consider an individual at point B faced with a moonlight job alternative which pays W' but requires that he work a fixed 15 hours. This combination (point D) will not improve his utility (he remains on U^0) and so he is unlikely to accept the second job offer.

Non labor income. The effect of non labor income in the model is to raise W^0 vertically by the amount of income. Again the effect on the moonlighting decision is ambiguous

because it depends on the slope of the individual's indifference curves and the primary and secondary wage rates. Under most circumstances, increases in non labor income will decrease the probability of an individual monnlighting or the number of moonlighting hours desired. Spouse's income could be considered under this factor but its effect is more complex. As well as raising the wage rate curve, a change in spouse's income also alters the shape of the indifference curves. As his spouse's work hours and income vary, an individual's valuation of his own leisure time will change because of the fluctuation in total household income and the tradeoffs made between spouses concerning household responsibilities.

These implications of the model have been borne out by research. Citing a number of other studies of moonlighting behavior William McNaught [1981] identified the following characteristics of moonlighters relative to single job holders:

- they earn smaller primary incomes,
- they work fewer hours on their primary job,
- they receive little non labor income,
- they incur greater household expenditures,
- they have larger families,
- they have more education,
- they are younger.

[McNaught,July 1981: p.10].

2. The Special Case of Reserve Participation

The model above is general and considers primarily economic motivations. There are a number of aspects of Reserve participation which distinguishes it from the civilian moonlighting decision.

First, the work schedule in the Reserve is inflexible. Reservists are committed to attend two days of drills per month and a two week active duty training period each summer. At any given Reserve wage this acts as a constraint on utility as shown in the model. Consequently, it restricts the potential supply of reservists.

Second, upon enlistment reservists are required to attend a period of full time initial training. Currently this is either twelve weeks or two periods of eight weeks. [Army Regulation 140-1,1983: p.22]. This may clash with the individual's primary job committments and preclude some potential reservists from enlisting. This full time training committment also may impact in other ways. It may be used by some to sample active duty military life before they commit themselves to an active duty enlistment. Also it may be attractive to unemployed people who may consider it as a legitimate job opportunity. Individuals in these categories serve to increase Reserve supply levels.

Third, an individual joining the Reserve enters an employment contract. This normally commits him to six years

of Reserve service and the possibility of being called to active duty in time of mobilization or civil emergency. It also legally subjects him to military discipline. This obligation probably dissuades some potential moonlighters from joining the Reserve and increases the relative attractiveness of civilian secondary job alternatives.

Fourth, there are a number of pecuniary benefits which accrue to reservists, which are not usually available in civilian moonlighting jobs. These include PX/commissary privileges, medical care and some retirement benefits at age 60. These all have some positive effect on Reserve supply.

There are also some non economic characteristics of Reserve participation which may prove attractive to individuals. The Reserve offers membership of a highly identifiable group. It offers esprit de corps, social contact and possible access to unique and potentially rewarding skills training. In this sense the Reserve could be likened to organizations such as volunteer fire departments and adventure clubs. The studies discussed below have borne out the importance of these types of benefits to reservists.

One Rand study on Reserve reenlistment found that reservists value these non pecuniary aspects of their jobs more highly than do their civilian moonlighting counterparts [Grissmer and Kirby,1985: p.22]. In a two year study of the

Army National Guard, Lowndes Stephens [1977] found that while economic incentives were of prime importance in recruiting and retaining reservists, considerations such as comradeship, group membership and a liking for the military environment also contributed significantly to the decision to join and remain in the Reserve.

B. A REVIEW OF MILITARY SUPPLY MODELS

Inception of the AVF concept for manning the US military in 1972 introduced a need for careful modelling of the supply of potential military enlistees. The impact of policy measures on supply levels must be understood if manning goals in the Active and Reserve forces are to be met efficiently. Since the mid-70's there have been numerous studies done on Active force supply. A recent review listed 23 such studies covering enlistments in all the services and DoD as a whole. [Borack et al,1985: p.5]. Far less attention has been given to Reserve supply.

There is one problem which continually re-occurs in studies of military supply. Almost all studies use regression analysis to model supply levels. Because of data constraints the dependent variable used is a measure of enlistment contracts signed or accessions. The problem is that the variable which is being modelled, potential military supply, is not always the same as the number of recruits enlisted. This is because the services set quotas

on enlistment levels. These quotas vary between services. Also, within services, different quotas apply for different categories of recriuts. This means that the variable researchers are measuring, supply, is actually a function of both potential supply and the enlistment quota. The implication is that results of studies which use demand constrained data do not accurately reflect the underlying relationships between the economic environment and potential supply. Methods which have been used to overcome this problem are discussed in more detail below.

1. Active Force Supply Studies

The large number of recent Active force studies precludes a review of all of them. Instead three of the more significant efforts are reviewed in detail below.

Goldberg, 1982. This was a comprehensive study which developed an econometric supply model for all services using pooled time series, cross section recruiting data from 1976 to 1980. The model was developed using log linear OLS regression. The dependent variable in the model was the number of male NPS high school graduates (HSG). The model was estimated separately for all HSG and those in mental categories I-IIIA. The independent variables in the model were:

- relative military / civilian pay,
- civilian unemployment,
- military education benefits,

- expenditures on Federal youth employment programs,
- population of 17-21 year old males,
- race,
- number of recruiters by service,
- Navy advertising budget (other services data was unavailable).

Goldberg handled the problem of demand constraints by focusing his analysis on the results pertaining to the male high quality sample (ie mental category I-IIIA HSG). This is a standard procedure in supply modelling. He claimed that this group is rarely demand constrained and therefore his model should produce accurate results. [Goldberg,1982: p.16].

For DoD recruits as a whole in the above sample Goldberg calculated supply elasticities of 1.31 for relative pay and .13 for civilian unemployment. Both of these results were statistically significant. [Goldberg,1982: p35]. Because of multicollinearity problems the effect of recruiters is hard to distinguish in the model. He concluded, however, that as well as own-service recruiters having a positive effect, the cross effects of other services recruiters on enlistment supply are also positive and significant. He estimated the average recruiter elasticity for DoD as .52. [Goldberg,1982: p.37].

Daula and Smith, 1984. This study rejects Goldberg's contention that using high quality enlistee

samples removes the problem of demand constraint contamination in study results. They contend that even high quality groups may be demand constrained in certain geographic areas. To overcome this problem they partition their data into two samples. One sample is data from areas where recruiting goals are met (i.e. supply constrained). The other sample is all the demand constrained data. The total sample consists of time series, cross section data from 54 Army recruiting districts by month from October 1980 to June 1983. [Daula and Smith,1984: p.6].

Using only supply constrained data they estimate a model to predict the number of high quality male Army enlistment contracts. They include the following independent variables in a log-linear OLS regression:

- military pay and bonuses,
- civilian pay,
- unemployment,
- qualified military population,
- percent minority,
- percent voting Republican,
- enlistment goals for all services and low quality Army enlistments
- number of Army recruiters and their experience,
- levels of national and regional advertising.

[Daula and Smith,1984: p.8]

To estimate the demand constrained model they use the following specification:

$$\ln P = Y \ln Q + (1-Y) \ln S + e \qquad \text{(eqn 2.1)}$$

- P = number of male high quality contracts
- Q = high quality goal
- $\mathcal{S}$ = expected value of enlistment supply (based on the supply constrained model)
- Y = weighting factor relating the goal and expected supply

The implication of this specification is that the imposition of a goal does not completely restrict supply but it does influence it. Observed supply is then modelled as a weighted average of potential supply and the enlistment goal. The greater the influence of the goal the closer the value of Y is to 1.0. If the goal is absolutely enforced Y equals 1.0. [Daula and Smith,1984: p.13].

The supply constrained model yielded statistically significant elasticities of 1.89 for relative pay and 1.36 for unemployment. The recruiter elasticity was 1.11 but the authors suspected an upward bias in this figure due to serial correlation resulting from the time series data and the model's specification. Also they found a high positive effect on enlistment due to post service education benefits. [Daula and Smith,1984: pp.20-23]

The demand constrained model produced relatively lower elasticities of -.824 for relative pay and .995 for unemployment. As expected the impact of the goal on enlistments was very significant. [Daula and Smith,1984: p.25].

One important result from this study came from estimating the supply function using only supply constrained data but including the high quality enlistment goal as an independent variable. The resulting coefficient of the goal variable was not significantly different from zero indicating that recruiter's goals have no effect on enlistments in supply constrained districts. [Daula and Smith,1984: p.20]. This result supports the validity of Daula and Smith's data partitioning methodology.

Dertouzos, 1985. This study analyses the effect of recruitment quotas on recruiter behavior in detail as well as developing an enlistment supply model. The study is based on Army cross section recruiting data from 1980 and 1981. Army recruiters are usually given two goals; one for high quality males and a total goal which is the sum of high and low quality recruits. Dertouzos points out that the incentives provided on the basis of these goals may not be consistent with the overall recruiting objective.

Historically recruiters have been rewarded for meeting their enlistment goals but not for exceeding them.

Also goals are set annually on the basis of previous years' enlistments. Based on the reward system the most sensible behavior for the recruiter is to meet his high quality goal, recruit only low quality to meet his total goal and then stop recruiting. This implies that after a certain point recruiters may begin to trade off potential high quality recruits in favor of lower quality so as not to exceed their goals. Dertouzos develops his supply model to test this hypothesis. [Dertouzos,1985: pp. 1-10].

The model is developed using two log linear OLS regression equations which are determined simultaneously. The dependent variables are the number of high and low quality recruits. The independent variables are:

- high quality quota,
- low quality quota,
- unemployment
- civilian wages,
- number of recruiters
- 15-19 year old male poulation,
- number of low quality recruits (only with the high quality dependent variable).

[Dertouzos,1985: p. 14].

The inclusion of the number of low quality recruits as an explanatory variable in the high quality specification allowed calculation of a tradeoff parameter between the two categories. This parameter is calculated for both data

samples and it reveals a consistent tradeoff figure of about four low quality recruits to one high quality recruit. This implies that a recruiting area by reallocating effort could attract one more high quality enlistment for every low quality enlistment it gives up. [Dertouzos,1985: p.19].

Other results from the study were estimates of -1.02 for civilian wage elasticity, .764 for unemployment elasticity and 1.19 for recruiter elasticity. [Dertouzos,1985: p.16].

The results of this study support the contention that demand considerations, in the form of recruitment goals, impact significantly on observed enlistment supply in all categories. This strongly suggests that using the assumption that male high quality recruits are never demand constrained is an inappropriate methodology for modelling enlistment supply.

2. Reserve Force Supply Studies

The results of active force supply studies are not directly applicable to the Reserves for two reasons. First, the majority of reservists have a full time civilian job and participation in the Reserve is a moonlighting decision. The model described earlier revealed a number of distinctions between the motivations for seeking primary and secondary labor market employment. Second, the Active force recruits and operates in a national labor market. The Reserves,

particularly the Army components, are forced to operate in local labor markets. Across the U.S. the economic and demographic factors that affect enlistments vary considerably between local areas.

This restriction to consideration at the local labor market level does not negate the importance of demand constraint in the Reserve supply modelling process. It is still plausible that in local areas potential supply may exceed recruiting quotas. A further complication is that the impact of quotas will be different across local labor markets because of the differences in the magnitudes of factors affecting potential supply.

There have been very few studies on Reserve enlistment supply done since the introduction of the AVF. The major ones are discussed below.

Rostker, 1974. This was part of a large study undertaken by the Rand corporation to investigate the impact of the AVF on the Air Force Reserve. Part of this study was the development of the moonlighting model discussed earlier. The study develops an econometric model of enlistment supply which is estimated using OLS regression. The dependent variable is the number of enlistment applications recorded (by age group, state and time period), divided by the appropriate eligible population. Independent variables in the model are:

- present value of a six year stream of Reserve income,

- present value of a six year stream of civilian income,
- population,
- age and region dummies.

This is not a very sophisticated model specification. Because of the time period of the study and the disaggregation to State level, the results obtained are not pertinent to this study.

Kelly, 1979. Kelly estimated supply models for both NPS and PS personnel using total DoD accessions as his dependent variable and relative pay, unemployment and population as independent variables. This analysis is disaggregated only to the State level and derived relative wage elasticities of .35 for PS supply and .10 for NPS supply. [Kelly,1979].

Mcnaught, June and July 1981. In these two studies McNaught reviews the work of Rostker and Kelly and points out a number of limitations and inconsistencies in their results. Combining those studies and the moonlighting model McNaught develops a theoretical model of Reserve supply.

$$R = f(W, C, S, H, U, P, I, T, X) \qquad \text{(eqn 2.2)}$$

- R = measure of Reserve participation
- W = Reserve wage
- C = civilian primary wage
- S = civilian secondary wage
- H = hours worked on primary job

- U = unemployment rate
- P = population of eligible enlistees
- I = stock of available information about the Reserve
- T = travel costs
- X = vector of seasonal, regional and time dummies

[McNaught,July 1985: p.12].

Because of data restrictions the model which McNaught estimates is much more restrictive than his theoretical model. Specifically , he disaggregates his data to the State level and includes no measure of travel cost, Reserve opportunity information, or recruiting goals. In his estimation McNaught concentrates on NPS enlistments and he looks at total DoD accessions without dissaggregating by component. He estimates his model using logit analysis with the ratio of number of NPS accessions to qualified population as the dependent variable. This specification attempts to predict the probability of an individual with a given set of characteristics enlisting in the Reserves. [McNaught,June 1981: p.36].

The studies' results are not very useful because State level estimation is a poor measure of local labor market effects. He calculates an unemployment elasticity of .81 [McNaught,June 1981: p.11], and a pay elasticity of .15 [McNaught,July 1981: p.38]. Borack, et. al. [1985] list four criticisms of McNaught's study:

- level of aggregation was too high,

- lack of measure of regional military interest,
- no consideration of the interaction between Reserve and Active recruiting systems,
- no consideration of the effect of local recruiting goals (demand) on enlistment supply by geographic area.

[Borack et al,1985: p.11].

The Reserve supply studies reviewed above are inconsistent and of limited use in estimating the effect of policy and demographic changes on potential supply. To improve the models the following considerations should be incorporated:

- Data should be analysed at the lowest level of geographic disaggregation possible.
- The impact of recruitment goals and quotas should be included.
- Accessions should be modelled by individual Reserve component.
- Cross effects of own and other Service, Active and Reserve recruiters should be included.

C. CONCLUSIONS

Theoretical analysis of the Reserve participation decision and a review of previous military supply studies suggest that a useful model of Reserve supply should explain the number of Reserve component accessions as a function of the following explanatory variables:

Economic.

- Reserve compensation - wages, bonuses and retirement benefits,
- other Reserve benefits,

- civilian primary job wages,
- hours worked on the primary job,
- civilian secondary job wages,
- local area unemployment rates.

Demographic.

- age structure of Reserve eligible population,
- race structure,
- education levels,
- family incomes,
- family sizes,
- distances to Reserve centres.

Recruitment Policies.

- number of recruiters by component (Active/Reserve),
- recruitment goals,
- measure of local military interest,
- advertising effort.

Naturally resrictions on available data and model specification may prevent some of these variables being included in an estimated model.

III. DATA AND METHODOLOGY

A. DATA SOURCES

Data for this thesis has been drawn from two major sources. The Reserve Components Common Personnel Data System (RCCPDS) which is maintained by the Defense Manpower Data Center was the source of data for Reserve accessions. A subset of all Reserve accessions for FY 83-85 inclusive was drawn from this file. The file contains personal and military employment history information on all Reserve accessions. [Department of Defense Instruction 7730.54, 1981].

Demographic and socio-economic data was drawn from the DORIS database maintained by the Defense Manpower Data Center. The data subset which was used contains socio-economic and demographic data disaggregated to the zip code level. The data used was gathered in the 1980 Census.

B. METHODOLOGY

1. Data Aggregation

The focus of this thesis was an investigation of the effect of local labor market conditions on Reserve supply. These effects are likely to be most significant on Army Reserve supply because these units are the most dependent of all components on local recruiting. Therefore this analysis

concentrated on a subset of data representing all accessions to the Army Selected Reserve only, in FY 83-85. This resulted in a pooled time series, cross section sample of 189,698 accessions in the period.

This sample was then further disaggregated into NPS and PS subsets. This was done because, as was discussed in the previous chapter, the factors affecting the Reserve participation decision of these two categories are quite different. One of the major variables explaining the level of PS accessions in a local labor market will of course be the pool of eligible PS personnel in that market. Because that data was not available for analysis in this thesis no models were developed for PS supply.

Additionally, no data was available on recruiting assets, goals or advertising at the local labor market level. The absence of this data precluded an analysis similar to that done by Daula and Smith [1984] and Dertouzos [1985] in which advanced modelling techniques were used to include these variables in supply models in an attempt to overcome the problem of demand constraint of the dependent variable.

These data restrictions constrained the modelling process in two ways. First, models could only be developed for NPS accessions. Second, in order to minimize the possible bias introduced by a demand constraint on the

dependent variable, it was necessary to develop the model using high quality accessions only. This group is the least likely to be demand constrained. This is consistent with the methodology used by Goldberg [1982].

Thus the accessions data was subsetted into high quality NPS males and females. These final groups had the following characteristics:

- No prior service in any Active or Reserve military component.
- High school graduate or above education level.
- Classified into Mental Group 1-3 on the basis of AFQT or Armed Services Vocational Aptitude Battery (ASVAB) score.
- 17-29 years old.

Once these final NPS samples were identified it was necessary to group the accessions into local labor market areas. The first step in achieving this was to accumulate aggregate counts of accessions by zip code of the home address of the recruit. These zip code counts were then aggregated upwards into counts by local labor market area using a special purpose program based on an algorithm supplied by USAREC. A local labor market was defined as an area encompassing all zip codes whose geographic center fell within a fifty mile radius of the geographic center of the zip code of an Army Reserve center. There were 994 such local labor markets defined across the U.S.

These local labor market accession counts were then merged with similarly aggregated demographic and socio-economic data from the DORIS database. This gave a final file which contained 994 records, each representing the local labor market of an Army Reserve center and each containing counts of all NPS male and female high quality accessions for FY 83-85 and the corresponding 1980 economic data. Data summaries of that file are shown in Table 4 and the variables are defined in more detail in Appendix A.

The wide disparity in demographic and economic characteristics across markets is explained by the fact that the markets are defined geographically by distance. A fifty mile radius around a Reserve center in Chicago is obviously significantly different from one around a center in the rural mid-west.

2. Model Specification

To investigate differences in Reserve supply behavior across local labor markets four different model specifications were estimated. These were:

- Standard linear models with male and female accession counts as the dependent variables.
- Multiplicative models (estimated using a log linear transformation) with male and female accession counts as the dependent variables.
- Standard linear models with male and female accession rates as the dependent variables.
- Multiplicative models (estimated using a log linear transformation) with male and female accession rates as the dependent variables.

TABLE 4

LABOR MARKET SUMMARY DATA

Variable	Mean	St Dev	Minimum	Maximum
NPS Male[1]	284	353	0	1897
NPS Female[1]	123	163	0	806
QMA Male[2]	200470	288835	1026	1588767
QMA Female[2]	208269	303930	801	1703465
% of Population Black	8.4	11.1	0	58.0
% of White Males Unemployed	6.4	2.9	0.9	19.8
% of Black Males Unemployed	4.6	3.0	0	15.5
% of White Females Unemployed	6.5	2.1	1.2	17.7
% of Black Females Unemployed	4.6	3.7	0	18.5
Av Family Income.	18431	3589	10202	29685
Av Family Size ..	3.4	0.2	2.9	4.6
Median Home Value	46345	18237	20241	138460
Median Home Rent.	215	49	91	362
% of Families with Dual Workers	53.0	5.8	29.0	64.0
% Population Change 1970-1980	13.2	13.3	-7.0	96.0
% of Workers by Industry				
Manufacturing ...	30.3	8.2	9.0	51.0
Service	47.3	6.0	34.0	68.0
Government	4.8	2.3	2.0	19.0
Seasonal	17.4	8.4	5.0	52.0

Note: 1. These are cumulative counts of all accessions in the category during FY 83-85.
2. Qualified Military Available, ie population aged 17-29 years.

These functional forms are discussed in more detail below.

Standard ordinary least squares (OLS) multiple regression models of the form in equation 3.1 were estimated

using NPS male and female counts as the dependent variables and the economic variables in Table 4 as the independent variables. This functional form was chosen because it is the simplest specification which could be used to estimate the market potential for any specific local market area. Relevant male or female QMA and unemployment variables only were included. The variable '% Change in Population' was specified as a dummy variable with a value of 1 being assigned if the change was positive and 0 otherwise. Because the variables representing industrial sectors are percentages, their values will sum to 1.0 in every market area. This leads to problems of multicollinearity which would bias the regression coefficients obtained. [Pindyck and Rubinfeld,1981: p.88]. To overcome this the variable 'service' is omitted when all the models are estimated.

$$Y = a + \sum_{i=1}^{n} b_i X_i + e_i \qquad \text{(eqn 3.1)}$$

The multiplicative functional form assumes a relationship of the type in equation 3.2.

$$Y = A \prod_{i=1}^{n} X_i^{b_i} . e_i \qquad \text{(eqn 3.2)}$$

This form was chosen because it has been the most commonly used in military supply modelling. For example it was used by Goldberg [1982] and Daula and Smith [1984]. This functional form assumes constant elasticities throughout the

model. The model is actually estimated using a log linear transformation of the form of equation 3.3 and the regression parameters obtained are in fact estimates of the supply elasticities of the variables. [Pindyck and Rubinfeld, 1981: p.109]. Because the logarithm of 0 is undefined the dummy variable for population change and any observation in which a variable had a value of 0 were omitted in this specification.

$$\ln Y = \ln a + \sum_{i=1}^{n} b_i (\ln X_i) + e_i \qquad \text{(eqn 3.3)}$$

In these two specifications it was anticipated that the QMA variable would significantly drive the explanatory power of the model. This was confirmed using stepwise regression techniques which showed that of the total variation in the dependent variable explained by the whole model approximately 95% was explained by the QMA variable alone.

To observe the effect of removing this influence from the model the third OLS specification was estimated in which the dependent variable was the ratio of the NPS accession count to the QMA base in the market (i.e. the accession rate). This model was estimated for both males and females. To overcome the estimation difficulties of having a dependent variable clustered close to zero the ratio was multiplied by 10,000. QMA was not included as an

independent variable. Thus the parameter estimates in this model measure the impact of the explanatory variables on the proportion of the eligible population who decided to join the Army Reserve.

The final model specification estimated was the multiplicative form of the previous model. Again this was estimated using a log linear transformation. Thus the dependent variable was log {(NPSM x 10,000) / QMAM}. This model was also estimated for female accessions. In both cases the independent variables were the logarithms of the appropriate economic variables in Table 4. QMA and population change were not included as independent variables in this model.

The empirical results obtained from estimating these models are discussed in the next chapter.

IV. EMPIRICAL ANALYSIS AND RESULTS

As described in the previous chapter, four model specifications were estimated in this analysis. Because their results are direct estimates of elasticities, only the estimates from the two logarithmic transformation specifications will be discussed in detail. The results of those models are contained in tables in this chapter. Results of the other specifications are listed in the appendices of this thesis.

A. DIRECT ACCESSION COUNT MODEL

Results obtained from estimating the log linear transformed model of the NPS male accession count are obtained in Table 5. Because this is a log linear model the coefficients obtained are estimates of the partial supply elasticities of the variables.

The most striking thing about this model is the very large R^2 value of .88. This is mainly due to the inclusion of the QMA variable. Its contribution alone, estimated using stepwise regression techniques, is .81. Although the relative explanatory power of the remaining variables is low, the coefficients for most of them are significantly different from zero, thus their impact on accessions cannot be discounted. The implications of the model's results are discussed in detail below.

TABLE 5

NPS MALE ACCESSION MODEL

Dependent Variable - log {NPS male accession count in each local labor market}

N = 802[1]

Explanatory Variables (natural log)	Coefficient	t Statistic
QMA Male	1.04 *	32.6
% of Population Black	-0.14 *	-6.0
% of White Males Unemployed	-0.07	-1.2
% of Black Males Unemployed	-0.10 *	-2.5
Average Family Income	2.22 *	9.7
Average Family Size	1.75 *	4.9
Median Home Value	-0.43 *	-3.9
Median Home Rent	-1.72 *	-6.1
% of Families with Dual Workers	-0.61 *	-2.8
% Population Change 1970-1980	Not Included	
% of Workers by Industry		
Manufacturing	o.27 *	2.0
Government	0.29 *	5.8
Seasonal	0.02	0.3
Intercept term	-16.35 *	-9.9

R^2 = .88

Note: 1. Some observations were excluded because they contained values of zero for some variables.
* - coefficient was different from zero at 5% level of significance.

QMA Male. The positive value of this elasticity is not surprising but it should be noted also that the magnitude is slightly greater than one. This implies slightly increasing scale effects as the QMA base of a local labor market expands. This result contrasts with the findings of Goldberg [1982]. In his study of Active force supply he found population elasticities considerably less than 1.0

although he had difficulty disentangling the combined effects of recruiters and population. [Goldberg,1982: p.44].

% of Population Black. This elasticity is quite small but the negative sign is unexpected in the sense that generally the military attracts disproportionate quantities of black recruits, particularly in the Active forces. One possible explanation for the sign may be that as the proportion of blacks in the population grows, holding QMA constant, fewer of the total eligible population opt for Reserve service simply because relatively more are joining the Active forces or looking for a satisfactory primary job. The coefficient does imply that areas with high concentrations of blacks may not be good Reserve recruiting grounds.

Unemployment Levels. Both unemployment coefficients are negative and very small in magnitude. This contrasts with the unemployment elasticity of .81 obtained by McNaught in his study although he was modelling total DoD accessions. [McNaught,June 1981: p.11]. Certainly a positive sign would be expected for these coefficients because the initial Reserve active duty commitment should be attractive to unemployed workers. The only mitigating factor would be a feeling that Reserve participation would hinder seeking or obtaining primary employment. It should also be noted that these data are unemployment rates across the entire work

force, not just 17-29 year olds. Also there may have been significant changes in the rates between 1980 when the unemployment rate was estimated and the FY 83-85 accession period. This would only create biases however, if the unemployment rates of the local labor markets changed relative to each other over this period. Otherwise, since this is essentially a cross sectional analysis, as long as relative unemployment rates were constant, the effect on accessions would not change.

Family Income. The high positive value of this elasticity conflicts with the economic theory of moonlighting. As family income rises the propensity to undertake secondary work, including the Reserves, should fall. One thing that should be noted is that this variable is not a proxy for wage rates, which in terms of this model would be constant across all market areas. Also the level of family income may not be a significant influence on the decisions of young adult family members still living with their parents to join the Reserve.

This result also gives credence to the suggestion discussed in Chapter 2, that participation in the Reserve may have significant non economic dimensions. That is, as income levels increase, younger people may be more disposed to join the Reserve for the esprit de corps and social contact it offers as opposed to opting for alternative

secondary jobs which may pay more but be less attractive overall.

Another consideration here is that this variable measures total family income, not just imcome from primary jobs. Thus as secondary labor market participation, including Reserve participation, increases so will total income levels. This relationship would imply a positive sign on this coefficient.

Family Size. The significant positive relationship between Reserve accessions and family size in the model is consistent with the findings of Shishko and Rostker in their analysis of multiple job holding. They explained the positive relationship between moonlighting hours and family size by claiming that family size was a proxy for consumption. Thus the heads of large families would seek secondary jobs in order to increase the family income. [Shishko and Rostker,1976: p.307].

The large value of the elasticity for solely Reserve participation is somewhat suspicious in terms of this explanation, however. Because of the fixed and relatively small number of hours that a Reservist works in a typical month, the Reserves should be less attractive than alternative forms of secondary employment to a man who is seeking secondary employment to feed and clothe his family. Also, as family size increases the costs of family

separation during periods of mandatory active service would probably increase.

Housing Costs. The significant negative coefficient on the two variables representing housing costs are difficult to explain. In their research on moonlighting behavior, Shishko and Rostker found a positive relationship between housing costs and moonlighting hours worked. [Rostker and Shishko,1974: p.16]. This is consistent with the economic theory which suggests that as family consumption (of which housing is a major part) rises the propensity of family members to moonlight rises. While difficult to explain the negative coefficients do suggest that as the relative affluence of a community rises the likelihood of its members joining the Reserve diminishes.

Dual Workers. The negative sign of this elasticity is exactly what would be expected. As Borack et. al. note:

> All other things equal, when a spouse enters the labor market, the potential Reservist perceives a higher family income and an increase in his household productivity. Consequently, he is less likely to take a second job. [Borack et al,1985: p.19].

Population Change. Because this is a dummy variable it could not be included in this log linear specification. The coefficient of this variable in the standard OLS NPS male model (Appendix B) was -103 and it was significantly different from zero. Because a value of one was assigned to

growing markets this coefficient implies that areas in which the population is declining will produce relatively more Reservists.

This is difficult to accept at face value and further research into the demographics of the population change, particularly in terms of age profiles and migration patterns, would be necessary before the correct implications of this result could be determined.

Industrial Mix. The surprising result here is the relatively similar elasticities for government and seasonal workers compared to manufacturing workers. One of the obstacles to Reserve participation is securing time off from a primary job to attend Reserve activities, despite the commitment of many employers to support the Reserve. It would be expected that these difficulties would accrue less to government and seasonal workers than others. For reasons discussed in Chapter 3, the service sector variable was deleted from the estimated model. Thus its impact is indirectly contained in the intercept term.

B. ACCESSION PROPORTION MODEL

The results of this model are contained in Table 6. The dependent variable in this model is the ratio of the number of accessions in a local labor market to the base of number of qualified military available in the population of the market. The ratio is multiplied by 10,000 to avoid

statistical problems which occur in the OLS estimation procedure when values of the dependent variable are clustered around zero and have little variance. [Pindyck and Rubinfeld,1981: p.52].

TABLE 6

ACCESSION PROPORTION MODEL

Dependent Variable:
log {(NPS male accessions x 10,000) / QMA Male}
N = 802[1]

Explanatory Variables (natural log)	Coefficient	t Statistic
QMA Male	Not included	
% of Population Black	-0.14 *	-5.0
% of White Males Unemployed	-0.07	-1.2
% of Black Males Unemployed	-0.10 *	-2.4
Average Family Income	2.32 *	10.9
Average Family Size	1.80 *	5.0
Median Home Value	-0.41 *	-3.8
Median Home Rent	-1.73 *	-6.1
% of Families with Dual Workers	-0.67 *	-3.2
% Population Change 1970-1980	Not Included	
% of Workers by Industry		
Manufacturing	0.28 *	2.1
Government	0.29 *	5.8
Seasonal	-0.01	-0.1
Intercept term	-8.08 *	-5.7

R^2 = .36

Note: 1. Some observations were excluded because they contained values of zero for some variables.
* - coefficient was different from zero at 5% level of significance.

The exclusion of QMA as an independent variable drops the explanatory power of the model significantly. The

resulting R^2 of .36 is, however, relatively large and again the majority of coefficients are significantly different from zero. Thus the model is useful in describing the characteristics of potentially high yield Reserve markets.

There is virtually no difference in the coefficients obtained between this model and the previous one. The signs all remain the same and the magnitudes vary only marginally. Although this does not add to the understanding of the Reserve participation decision the result is still useful to some extent. These results show that the characteristics of potentially good Reserve recruiting areas remain unchanged whether we measure that potential as a simple count or as a ratio which represents the propensity of eligible individuals in a market to enlist in the Reserve. This consistency reinforces the conclusions drawn in the previous section from the empirical results which have been obtained.

C. SUMMARY OF RESULTS

Despite the relatively high explanatory power of the models estimated in this analysis the estimates are of little use in direct policy formulation. This is because the variables used do not include any supply policy instruments.

The major significance of the results is the support they provide to the central hypothesis of this study: that the factors affecting Reserve supply differ across local labor markets and are dependent upon the characteristics of

those markets. This implies that future research to develop an understanding of the Reserve participation decision should disaggregate the analysis to at least the local labor market level.

Another contribution of the results is that they define, to some extent, the characteristics of a local labor market which is likely to provide viable results for Reserve recruiting effort. This type of information is potentially useful when questions of unit location are considered.

Based on the results listed in this chapter and the appendices a high yield Reserve market would have the following characteristics:

- high proportion of qualified military available in the population.
- relatively low proportion of blacks.
- relatively high levels of income and general affluence.
- relatively large average family size.
- low proportion of families with dual workers.

V. CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH.

A. CONCLUSIONS

Consideration of the economic model of moonlighting, particularly in its application to the Reserve participation decision, suggested that differences in the factors affecting Reserve supply would exist across local labor markets. The results obtained in this analysis support that hypothesis. Due to the restricted economic data available for analysis at the local market level however the model provides little effective assistance for Reserve manpower supply policy formulation.

The major strength of the models developed here would be in identifying characteristics of local markets which could be expected to provide a high yield for Reserve units located there. In that sense this is a useful first step in developing a comprehensive Reserve supply model.

Certainly the results of this study strongly suggest that in future efforts to develop Reserve supply models the analysis should be disaggregated to at least the local labor market level if meaningful policy direction is to be obtained. It should also be noted that the local level is the management decision making level for the Army Reserve.

B. AREAS FOR FURTHER RESEARCH

This analysis has concentrated on the relationship between NPS, high quality Army Reserve accessions and the economic characteristics of local labor markets. While the level of disaggregation is probably correct the scope of the analysis must be widened considerably to develop a comprehensive Reserve supply model. Major dimensions of Reserve supply which should be added to this analysis are discussed below.

PS Accessions. As shown in Chapter 1 these represent a large proportion of total Reserve accessions. To effectively model this area of Reserve supply data would need to be gathered on the size of eligible veteran pools in local labor markets. There is also a need to distinguish in the modelling process between those PS personnel who are recruited into the Reserve by in-service recruiters (ISR) before they actually leave the Active force and those who join the Reserve after some time out of the Active force. Obviously local labor market conditions would have little effect on the decisions of the former category of recruits whilst their effect on the latter could be significant.

Other Reserve Components. A natural extension of the analysis would include modelling the supply of the Army National Guard and Navy and Air Force Reserve components. It is possible that because of their operational

characteristics the Air Force and Navy components will not be as dependent on the local labor market for recruits as the Army components. If this is so some redefinition of the appropriate market may be required.

Recruiting Effort. The work of Daula and Smith [1984] and Dertouzos [1985] clearly indicated the impact which recruiting resources and goals have on military supply levels. A major development of this analysis would be to use techniques similar to those employed by these researchers to estimate the impact of recruiting resources (ie number of recruiters and advertising expenditures) and goals at the local market level. Alternatively, this could be accomplished by examining the fill rates (ratios of assigned to authorized levels) of Reserve units and centers. This would enable the analysis to be broadened from the high quality recruit category by overcoming the problem of demand constraint of the dependent variable.

In undertaking this type of analysis both the direct impact of own- service recruiters and the cross effects of other service recruiters should be estimated. The objective of the analysis would be to determine the correct local mix of Active and Reserve recruiters of each component, advertising exposure and recruiting goals which would meet the manning objectives of all local Reserve units at least total cost to DoD.

Additional Explanatory Variables. The economic theory discussed in Chapter 2 suggests that the following variables would have an impact on the Reserve participation decision:

- Relative wages - Reserve wages, primary civilian wages and secondary wages.
- Other pecuniary Reserve benefits such as medical and education assistance.
- Hours worked on primary jobs.
- Average local education levels.
- Unemployment in the 17-29 year age group rather than total unemployment levels.

The inclusion of these variables, if they could be measured or estimated at the local market level, would increase the usefulness of the model as a policy analysis tool. The quality of the model would also be improved if the data used was updated to current levels as opposed to the 1980 values used in this analysis.

APPENDIX A

VARIABLE DEFINITION

NPS Male/Female. Cumulative counts of all NPS accessions in the appropriate category during FY 83-85 inclusive. NPS implies no prior service in any Active or Reserve component.

QMA Male/Female. Qualified military available. This is a count of the male/female population in the market area aged 17-29 years.

% of Population Black. Total number of blacks divided by the total population in each market in 1980. (All ages and sexes).

Average Family Income. Average income accruing to all families in the market area from all sources in 1980.

Average Family Size. Average number of family members in 1980.

Median Home Value. Median value of all family homes in the market area in 1980.

Median Home Rent. Median rent paid for all dwellings in the market area in 1980.

% of Families with Dual Workers. Number of families with two or more members holding full or part time jobs in 1980.

% Population Change. Total population figures for each market area. {(1980 - 1970) / 1970} x 100.

Manufacturing Workers. Proportion of workers reported in census classifications 'manufacturing', 'transport' and 'communications' in 1980 in each market area.

Service Workers. Proportion of workers reported in census classifications 'wholesale', 'retail', 'finance', 'service', 'recreation', 'health', 'education', and 'other' in 1980 in each market area.

Government Workers. Proportion or workers reported in 'government' census classification in 1980 in each market area.

Seasonal Workers. Proportion of workers reported in census classifications 'agriculture' and 'construction' in 1980 in each market area.

APPENDIX B

ACCESSION COUNT MODELS RESULTS

Explanatory Variables	Dependent Variables NPS Male Accession		NPS Female Accession	
QMA[1]	0.001	*	0.0004	*
% of Population Black	-223.6	*	16.7	
% of White Males Unemployed ..	-5.42		-	
% of Black Males Unemployed ..	-13.1	*	-	
% of White Females Unemployed.	-		1.29	
% of Black Females Unemployed.	-		-1.03	
Average Family Income	0.05	*	0.03	*
Average Family Size	209.4	*	5.75	
Median Home Value	-0.003	*	0	
Median Home Rent	-2.9	*	-1.6	*
% of Families with Dual Workers	-425.4	*	-51.6	
% Population Change 1970-1980	-103.0	*	-33.3	*
% of Workers by Industry				
Manufacturing	-644.2	*	-31.6	
Government	-169.5		1357	*
Seasonal	-1234	*	-104.0	
Intercept term	142.3		-92.4	
N = 802 ; R^2	.88		.90	

Note: 1. Qualified military available of appropriate sex.

* - coefficient was different from zero at 5% significance level.

APPENDIX C

ACCESSION PROPORTION MODELS RESULTS

Explanatory Variables	Dependent Variables NPS Male Ratio		NPS Female Ratio	
% of Population Black	-15.9	*	1.4	
% of White Males Unemployed ..	-0.40	*	-	
% of Black Males Unemployed ..	-0.88	*	-	
% of White Females Unemployed.	-		0.11	
% of Black Females Unemployed.	-		-0.08	
Average Family Income	0.001	*	0.001	*
Average Family Size	12.25	*	1.42	
Median Home Value	0		0	
Median Home Rent	-0.18	*	-0.09	*
% of Families with Dual Workers	-24.6	*	3.12	
% Population Change 1970-1980	-1.89	*	-0.66	*
% of Workers by Industry				
Manufacturing	-16.8	*	-16.7	*
Government	-9.5		8.3	
Seasonal	-32.3	*	-19.2	*
Intercept term	20.3	*	14.1	*
N = 802 ; R^2	.29		.24	

Note: 1. Qualified military available of appropriate sex.
* - coefficient was different from zero at 5% significance level.

APPENDIX D

FEMALE LOG LINEAR MODELS RESULTS

Explanatory Variables (natural logs)	Dependent Variables (natural logs) NPS Female Accessions		NPS Female Ratio	
QMA Female	1.10	*	-	
% of Population Black	-0.04		-0.03	
% of White Females Unemployed.	-0.03		-0.05	
% of Black Females Unemployed.	-0.01		-0.01	
Average Family Income	2.11	*	2.35	*
Average Family Size	1.12	*	1.32	*
Median Home Value	-0.19		-0.14	
Median Home Rent	-2.05	*	-2.03	*
% of Families with Dual Workers	0.07		-0.14	
% of Workers by Industry				
Manufacturing	0.31	*	0.36	*
Government	0.48	*	0.48	*
Seasonal	0.21	*	0.12	
Intercept term	-15.26	*	-8.52	*
N = 802 ; R^2	.87		.26	

Note: * - coefficient was different from zero at 5% significance level.

LIST OF REFERENCES

Borack, J., Mehay, S. and Thomas, G., Estimating Local Area Manpower Supply for the Reserves, NPS 54-85-006, Department of Administative Sciences, Naval Postgraduate School, September 1985.

Brinkerhoff, J. and Grissmer, D., The Reserve Forces in an All Volunteer Environment, Rand P-6934, Santa Monica, January 1984.

Congressional Budget Office, Improving the Army Reserve, Congress of the United States, Washington DC, November 1985.

Daula, T. and Smith, D., Recruiting Goals, Enlistment Supply and Enlistments in the US Army, US Army Manpower Economics Conference, Virginia, December 1984.

Department of Defense Instruction 7730.54, Reserve Components Common Personnel Data System, Washington DC, October 1981.

Department of the Army, Army Regulation 140-1, Army Reserve: Mission, Organization and Training, Washington DC, April 1983.

Dertouzos, J., Recruiter Incentives and Enlistment Supply, Rand R-3065-MIL, Santa Monica, May 1985.

Defense Manpower Data Center, Official Guard and Reserve Manpower Strengths and Statistics, RCS: DD M(M) 1147/1148, Washington DC, September 1985.

Goldberg, L., Enlisted Supply: Past, Present and Future, CNS 1168-Vol 1, Centre for Naval Analysis, Virginia, September 1982.

Grissmer, D. and Kirby, S., Attrition and Retention in the Army Reserve and Army National Guard: An Empirical Analysis, Rand P-7077, Santa Monica, March 1985.

Kelly, R., The Supply of Volunteers to the Selected Reserve, Department of Social Sciences, USMA, May 1979. (mimeo)

McNaught, W., Projecting Future Accessions to the Selected Reserve Forces, Rand N-1563-MRAL, Santa Monica, June 1981.

McNaught, W., The Supply of Enlistees to the Selected Reserve Forces, Rand N-1562-MRAL, Santa Monica, July 1981.

Pindyck, R. and Rubinfeld, D., Econometric Models and Economic Forecasts, McGraw-Hill, New York, 1981.

Rostker, B., Air Reserve Personnel Study: Volume III. Total Force Planning Personnel Costs and the Supply of New Reservists, Rand R-1430-PR, Santa Monica, October 1974.

Rostker, B. and Shishko, R., The Economics of Secondary Labor Market Participation, Rand P-5283, Santa Monica, August 1974.

Shishko, R. and Rostker, B., "The Economics of Multiple Job Holding", American Economic Review, Vol 66 No 3, June 1976.

Stephens, L., "Recruiting and Retaining the Citizen-Soldier", Armed Forces and Soceity, Vol 4 No 1, November 1977.

INITIAL DISTRIBUTION LIST

No.		Copies
1.	Defense Technical Information Center Cameron Station Alexandria, Virginia 22304-6145	2
2.	Library, Code 0142 Naval Postgraduate School Monterey, California 93943-5000	2
3.	Professor George W. Thomas Code 54Te Naval Postgraduate School Monterey, California 93943-5000	12
4.	Professor Stephen L. Mehay Code 54Mp Naval Postgraduate School Monterey, California 93943-5000	12
5.	Captain B.G. Holzberger 16 Peppercorn Street Sunnybank Hills, QLD, 4109 Australia	1

END

12-86

DTIC